Instavine

Manan Vyas

Nicholas Yingst

Shruti Sharma

USCViterbi
School of Engineering

University of Southern California

Introduction

- The aim of this project is to take the features of the famous image editing app, Instagram, one step further and create a real-time video version of the filters. We have named it InstaVine.

- The filters implemented on the video are image filters applied to each frame of the video. Due to the algorithms running in real-time and without manual intervention, the filters are adaptive.

Hardware and Setup

- DSP Board:

    We chose DM6437 because:

    - 720x480i I-O Video resolution (Better Quality)

    - can connect to external displays (Helps in demo)

    Drawbacks:

    - internal memory: 256kB

    - clock speed: 600MHz

- Camera: Canon 7D

- User Interface: Combination of DIP switches on the board will select various filters

Pencil Sketch

- Algorithm: Edge Detection Using Adaptive Canny

- Result:

Vignette

- Algorithm: Skin Color Segmentation + Faded Mask Overlay

- Result:

Colored Foreground with Grayscale Background

- Algorithm: Skin Segmentation + Faded Grayscale Mask Overlay

- Result:

Metallic Emboss

- Algorithm: The emboss filter gives a 3D shadow effect to the image, essentially by taking the bump-map of the frames along the diagonal.

- Complexity : O(MN)

- Results:

Error Diffusion and Dithering

- Algorithm: Halftoning using the thresholding matrix. Error Diffusion : Distribute the quantization residual to neighboring un-processed.

- Serpentine Scanning to ensure proper error distribution

- Complexity : O(MN)

- Results:
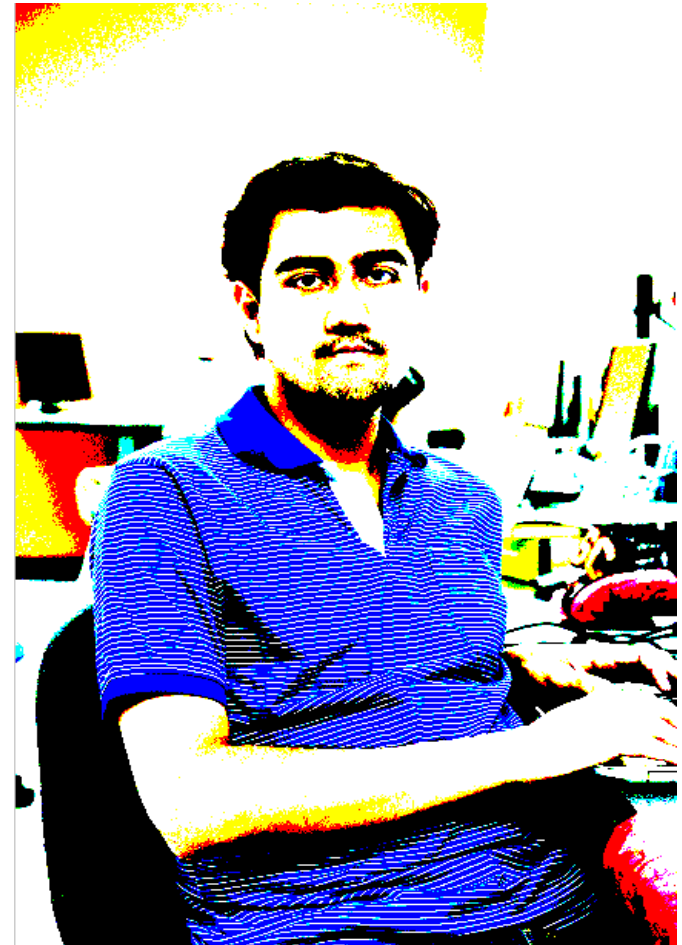
Comic Book

- Algorithm: Add the original image to edge enhanced (sharperned) image while preserving the brightness.

- Decided to use the "sharpen" as the actual Comic Book Effect for the demo as it "visibly" better than Error Diffusion

- Complexity : O(MN)

- Results:

Cartoonize:
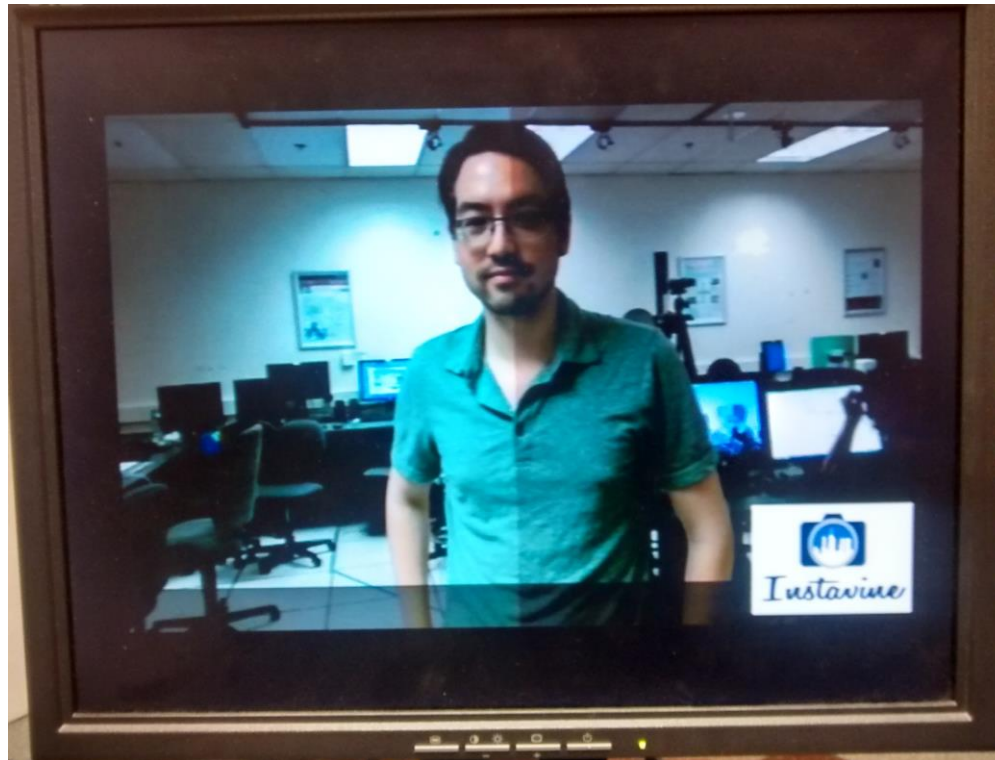
- Algorithm: Add adaptive egde map to the bilateral filtered image.

- Complexity of Bilateral : $O(|N|.\log(\sigma))$

- Complexity of Adaptive Edge Map : $O(MN.\log(MN))$

- Too complex and slow to run on the board even after optimizations !

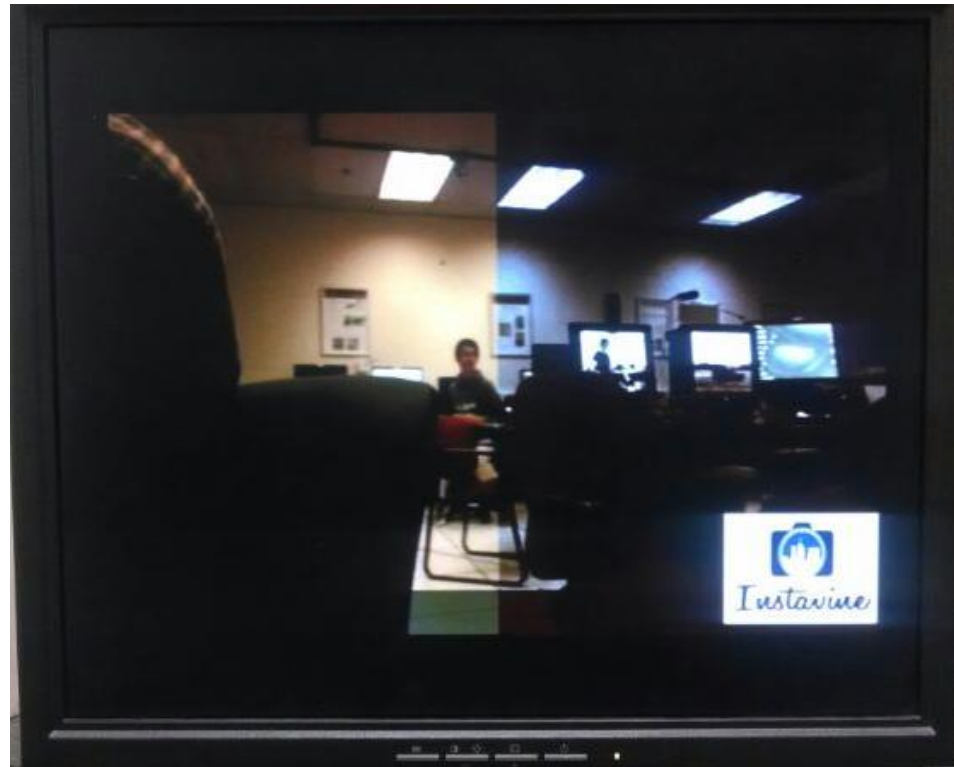- Results:

White Balance Correction

- Algorithm: Histogram Stretching

- Result:

Color Temperature

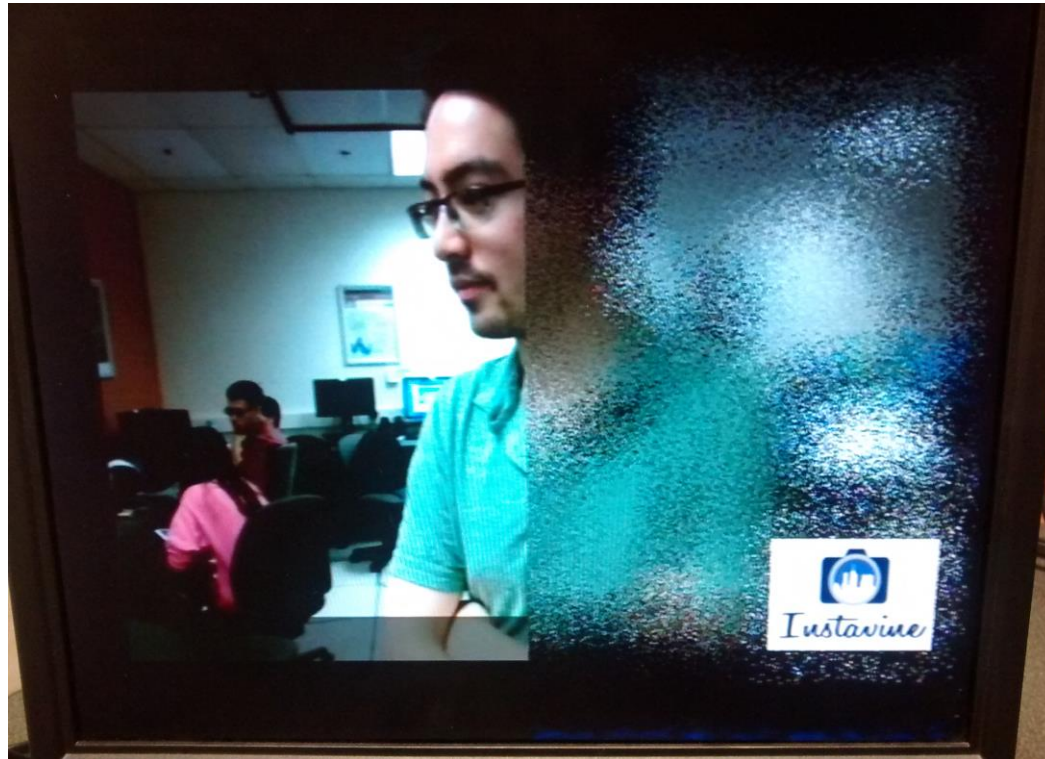- Algorithm: Color Mixing + Luminance Preservation

- Result:

Sepia

- Algorithm: Color Channel Cross Mixing + Gamma Correction

- Result:

Dissolve

- Result:

Optimization Techniques

- Integer math

- Look-up tables

- Pre-fetching pixels/blocks of pixels

Checklist

Promised	Delivered
Pencil Sketch	Pencil Sketch
White balance correction +Contrast Enhancement	White balance correction + contrast enhancement
Foreground-background separation	Skin color segmentation + Vignette and grayscale effects
Vignette	
Comic-book effect	Comic-book effect
Oil Painting	Sepia - tone
	Emboss effect
	Dissolve effect
	Color temperature conversion

References:

[1] Y.; Cetin A.E. Akarun, L.; Yardunci. Canny edge detection codec using vlib on davinci series dsp. In International Conference on Computer Science and Service System (CSSS), pages 221,224, 11-13 August 2012.

[2] Y.; Cetin A.E. Akarun, L.; Yardunci. Adaptive methods for dithering color images. In IEEE Transactions on IEEE, vol.6, no.7, pages 950,955, Jan 1997.

[3] A.U.; Allebach J.P. Baqai, F.A.; Je-Ho Lee; Agar. Digital color halftoning. In Signal Processing Magazine,IEEE,vol. 22, pages 87,96, Jan 2005.

[4] K. J. Sungkuk Chun. Oil painting rendering changeable by light eect. Soongsil University, HCI Lab.

[5] Luo Tao; Xi feng Zheng; Ding Tie-fu. Self-adaptive threshold canny operator in color image edge detection. In 2nd International Congress on Image and Signal Processing, CISP '09, pages 1,4, 17-19 October 2009.

[6] Theo; Weijer Joost V.D. Gijsenij, Arjan; Gevers. Computational color constancy: Survey and experiments. In IEEE Transactions On Image Processing, 2010.[August 1996].